



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Kostas F. Dockus, *et al.*

Appl. No. 09/990,507

Filed: November 21, 2001

For: **METHODS FOR FLUXLESS  
BRAZING**

Art Unit: 1775

Examiner: Zimmerman

Atty. Docket: 02057.0167.NPUS00

*Confirmation No. 3423*

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**Reply and Amendment Under 37 C.F.R. § 1.111**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated August 11, 2003, (PTO Prosecution File Wrapper Paper No. 9), Applicants submit the following Amendment and Remarks.

It is not believed that extensions of time or fees for net addition of claims are required beyond those that may otherwise be provided for in documents accompanying this paper. However, if additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to our Deposit Account No. 08-3038 referencing docket number 02057.0167.NPUS00.

*Amendments*

Kindly enter the following amendments to the claims, canceling claims 1-56, and adding new claims 57-116.

1 -56. (cancelled)

57. (new) An article of manufacture for use in a fluxless brazing process, the article of manufacture comprising:

- (a) a substrate comprising aluminum or an aluminum alloy;
- (b) a bonding layer provided on the substrate, the bonding layer consisting of one or more metals selected from nickel, lead, bismuth, antimony and thallium; and
- (c) a braze-promoting layer on the bonding layer, the braze-promoting layer comprising one or more metals selected from nickel, cobalt and iron.

58. (new) An article of manufacture according to claim 57, wherein the substrate comprises a core layer and a clad layer formed of aluminum or an aluminum alloy, and wherein the bonding layer is disposed on the clad layer.

59. (new) An article of manufacture according to claim 58, comprising a brazing product selected from a brazing sheet and a brazing preform, wherein the core layer is comprised of aluminum or an aluminum alloy.

60. (new) An article of manufacture according to claim 58, wherein the clad layer comprises an aluminum alloy containing aluminum and one or more alloying elements selected from silicon, magnesium, zinc and manganese.

61. (new) An article of manufacture according to claim 60, wherein the clad layer comprises an aluminum brazing alloy comprising aluminum and 2-18% silicon.

62. (new) An article of manufacture according to claim 57, comprising a brazing preform, wherein the substrate comprises an aluminum brazing alloy, the aluminum brazing alloy comprising aluminum and 2-18% silicon.

63. (new) An article of manufacture according to claim 57, wherein the braze-promoting layer comprises nickel.

64. (new) An article of manufacture according to claim 57, wherein the braze-promoting layer comprises nickel in combination with one or more metals selected from the group comprising lead, bismuth, magnesium, lithium and thallium.

65. (new) An article of manufacture according to claim 57, wherein the braze-promoting layer comprises nickel and lead.

66. (new) An article of manufacture according to claim 57, wherein the braze-promoting layer comprises nickel and bismuth.

67. (new) An article of manufacture according to claim 57, wherein the braze-promoting layer has a thickness of not more than about 2.0  $\mu\text{m}$ .

68. (new) An article of manufacture according to claim 57, wherein the braze-promoting layer has a thickness of between 0.5 and 1.0  $\mu\text{m}$ .

69. (new) An article of manufacture according to claim 57, wherein the bonding layer comprises lead.

70. (new) An article of manufacture according to claim 57, wherein the bonding layer comprises bismuth.

71. (new) An article of manufacture according to claim 57, wherein the bonding layer comprises antimony.

72. (new) An article of manufacture according to claim 57, wherein the bonding layer comprises nickel.

73. (new) An article of manufacture according to claim 57, wherein the bonding layer comprises a codeposit of nickel with lead, bismuth or thallium.

74. (new) An article of manufacture according to claim 57, wherein the bonding layer has a thickness of not more than 0.5 µm.

75. (new) An article of manufacture according to claim 57, wherein the bonding layer has a thickness of not more than 0.3 µm.

76. (new) An article of manufacture for use in a fluxless brazing process, the article of manufacture comprising:

(a) a substrate comprising aluminum or an aluminum alloy;

(b) a bonding layer provided on the substrate, the bonding layer comprises nickel in combination with one or more metals selected from lead, bismuth, antimony, thallium, tin and zinc; and

(c) a braze-promoting layer on the bonding layer, the braze-promoting layer comprising one or more metals selected from nickel, cobalt and iron.

77. (new) An article of manufacture according to claim 76, wherein the bonding layer comprises a codeposit of zinc with nickel.

78. (new) An article of manufacture according to claim 76, wherein the bonding layer comprises a codeposit of tin with nickel.

79. (new) An article of manufacture for use in a fluxless brazing process, the article of manufacture comprising:

(a) a substrate comprising aluminum;

(b) a bonding layer provided on the substrate, the bonding layer comprising one or more metals selected from the group consisting of nickel, lead, bismuth, antimony, thallium, zinc and tin;

(c) an inner braze-promoting layer provided on the bonding layer, the inner braze-promoting layer comprising one or more metals selected from the group consisting of nickel, cobalt and iron; and

(d) an outer braze-promoting layer provided on the inner braze-promoting layer, the outer braze-promoting layer comprising one or more metals selected from the group consisting of nickel, cobalt and iron.

80. (new) An article of manufacture according to claim 79, wherein the substrate comprises a core layer and a clad layer formed of aluminum or an aluminum alloy, and wherein the bonding layer is disposed on the clad layer.

81. (new) An article of manufacture according to claim 80, comprising a brazing product selected from a brazing sheet and a brazing preform, wherein the core layer is comprised of aluminum or an aluminum alloy.

82. (new) An article of manufacture according to claim 80, wherein the clad layer comprises an aluminum alloy containing aluminum and one or more alloying elements selected from silicon, magnesium, zinc and manganese.

83. (new) An article of manufacture according to claim 80, wherein the clad layer comprises an aluminum brazing alloy comprising aluminum and 2-18% silicon.

84. (new) An article of manufacture according to claim 79, comprising a brazing preform, wherein the substrate comprises an aluminum brazing alloy, the aluminum brazing alloy comprising aluminum and 2-18% silicon.

85. (new) An article of manufacture according to claim 79, wherein each of the inner and outer braze-promoting layers comprises nickel.

86. (new) An article of manufacture according to claim 79, wherein each of the inner and outer braze-promoting layers comprises nickel in combination with one or more metals selected from the group comprising lead, bismuth, magnesium, lithium and thallium.

87. (new) An article of manufacture according to claim 79, wherein the inner braze-promoting layer comprises nickel and lead, and the outer braze-promoting layer comprises nickel.

88. (new) An article of manufacture according to claim 79, wherein the inner braze-promoting layer comprises nickel and bismuth, and the outer braze-promoting layer comprises nickel.

89. (new) An article of manufacture according to claim 79, wherein the inner braze-promoting layer comprises nickel, and the outer braze-promoting layer comprises nickel and lead.

90. (new) An article of manufacture according to claim 79, wherein the inner braze-promoting layer comprises nickel, and the outer braze-promoting layer comprises nickel and bismuth.

91. (new) An article of manufacture according to claim 79, wherein the inner and outer braze-promoting layers have a combined thickness of not more than about 2.0  $\mu\text{m}$ .

92. (new) An article of manufacture according to claim 79, wherein the inner and outer braze-promoting layers have a combined thickness of between 0.5 and 1.0  $\mu\text{m}$ .

93. (new) An article of manufacture according to claim 79, wherein the bonding layer is comprised of at least 50% by weight of a metal selected from the group consisting of zinc and tin.

94. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises lead.

95. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises bismuth.

96. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises antimony.

97. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises nickel.

98. (new) An article of manufacture according to claim 97, wherein the bonding layer further comprises one or more metals selected from the group consisting of lead, bismuth, antimony, tin and zinc.

99. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises a codeposit of nickel with lead, bismuth or thallium.

100. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises a codeposit of zinc with nickel.

101. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises a codeposit of tin with nickel.

102. (new) An article of manufacture according to claim 79, wherein the bonding layer comprises a codeposit of zinc with lead, bismuth or thallium.

103. (new) An article of manufacture according to claim 79, wherein the bonding layer has a thickness of not more than 0.5  $\mu\text{m}$ .

104. (new) An article of manufacture according to claim 79, wherein the bonding layer has a thickness of not more than 0.3  $\mu\text{m}$ .

105. (new) A method of manufacturing an assembly of components joined by brazing, the method comprising:

- (a) providing a first component comprised of aluminum, aluminized metal, nickel-coated titanium, nickel-coated steel or steel;
- (b) providing a second component comprised of aluminum, aluminized metal, nickel-coated titanium, nickel-coated steel or steel;

(c) providing a third component comprising an article of manufacture according to claim 57;

(d) combining said components to provide said assembly;

(e) brazing the assembly in a non-oxidizing environment in the absence of a brazing flux at elevated temperature for a period long enough for brazing to occur; and

(f) cooling the assembly.

106. (new) A method according to claim 105, wherein the substrate of the article of manufacture comprises a core layer and a clad layer formed of aluminum or an aluminum alloy, and wherein the bonding layer is disposed on the clad layer.

107. (new) A method according to claim 106, wherein the article of manufacture comprises a brazing product selected from a brazing sheet and a brazing preform, wherein the core layer is comprised of aluminum or an aluminum alloy.

108. (new) A method according to claim 106, wherein the clad layer of the article of manufacture comprises an aluminum alloy containing aluminum and one or more alloying elements selected from silicon, magnesium, zinc and manganese.

109. (new) A method according to claim 106, wherein the clad layer of the article of manufacture comprises an aluminum brazing alloy comprising aluminum and 2-18% silicon.

110. (new) A method according to claim 105, wherein the article of manufacture comprises a brazing preform and wherein the substrate comprises an aluminum brazing alloy comprising aluminum and 2-18% silicon.

111. (new) A method of manufacturing an assembly of components joined by brazing, the method comprising:

- (a) providing a first component comprised of aluminum, aluminized metal, nickel-coated titanium, nickel-coated steel or steel;
- (b) providing a second component comprised of aluminum, aluminized metal, nickel-coated titanium, nickel-coated steel or steel;
- (c) providing a third component comprising an article of manufacture according to claim 79;
- (d) combining said components to provide said assembly;
- (e) brazing the assembly in a non-oxidizing environment in the absence of a brazing flux at elevated temperature for a period long enough for brazing to occur; and
- (f) cooling the assembly.

112. (new) A method according to claim 111, wherein the substrate of the article of manufacture comprises a core layer and a clad layer formed of aluminum or an aluminum alloy, and wherein the bonding layer is disposed on the clad layer.

113. (new) A method according to claim 112, wherein the article of manufacture comprises a brazing product selected from a brazing sheet and a brazing preform, wherein the core layer is comprised of aluminum or an aluminum alloy.

114. (new) A method according to claim 112, wherein the clad layer of the article of manufacture comprises an aluminum alloy containing aluminum and one or more alloying elements selected from silicon, magnesium, zinc and manganese.

115. (new) A method according to claim 112, wherein the clad layer of the article of manufacture comprises an aluminum brazing alloy comprising aluminum and 2-18% silicon.

116. (new) A method according to claim 111, wherein the article fo manufacture comprises a brazing preform and wherein the substrate comprises an aluminum brazing alloy comprising aluminum and 2-18% silicon.